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## NOTES ON THE CŒLENERATE FAUNA OF WOODS HOLE.

CHARLES W. HARGITT.

THE following notes upon certain faunal features of the cœlenterate life of Woods Hole and adjacent waters pertain chiefly to the season just past, including records which are fairly constant at regular intervals throughout the entire year. For certain of them I am indebted to Mr. Vinal Edwards, whose painstaking records during many years are matters well known to many naturalists. I am also under obligations to Mr. George M. Gray and Dr. H. M. Smith for similar favors. In addition to notes upon the seasons, habits, etc., brief accounts are presented of new forms discovered and of the development of one of the Scyphomedusæ.

### HYDROMEDUSÆ.

*A New Tubularian Hydroid.*—In August, 1900, while cruising and dredging in Muskegat Channel off Marthas Vineyard, a considerable number of fine specimens of *Corymorpha pendula* Ag. were taken by dredge and trawl, many of which were in fine condition, still imbedded in the sand as in normal life. A somewhat cursory examination of the specimens showed what seemed to be young specimens growing among the filamentous rootlike holdfasts and apparently budding from the base of the hydroid, like young polyps, reference to which fact was made by the present writer in the recently published synopsis of Hydromedusæ. In order to determine more definitely the apparent anomaly of buds arising from so low among the rhizoids and below the sandy surface of the substratum, and whether they might show signs of later becoming detached, the specimens were submitted to one of my students, Mr. A. J. May, with instructions to determine the range of budding, nature of

development, etc. The results have shown what was only at first dimly suspected, namely, that the small "buds" were in fact not buds at all, but a distinct hydroid, apparently parasitic, growing upon the base of the Corymorpha. This was clearly demonstrated both from the specific differences which a critical study of its morphology showed, and by means of sections made through the points of attachment. The point of attachment is within a rather limited zone of the base, among the conical papillæ and filamentous rhizoids of the host, where in some cases as many as half a dozen were growing upon the same

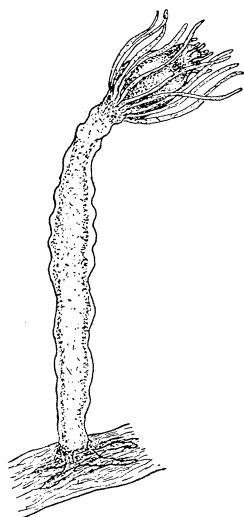


FIG. 1. — *Tubularia parasitica*.

specimen. As will be noted from Figs. 1 and 2, the new hydroid clearly belongs to the genus *Tubularia*, having the characteristic form of body, arrangement of tentacles, etc. Its attachment to the host was quite close, being inserted within the filmy perisarc, where its base expanded in the form of fingerlike absorbent organs.

Briefly its characters may be summarized as follows: Hydranth solitary, from 2 to 5 mm. in height and about  $\frac{1}{8}$  mm. in diameter; tentacles in two whorls, the proximal of from eight to sixteen, the distal of from five to eight. Gonads were found upon but one specimen, and in this were immature, but occupying the characteristic position among the basal tentacles. So far as known, semi-parasitic upon *Corymorpha*. I propose for it the provisional name *Tubularia parasitica*, till further investigations may be had upon additional and more mature specimens, which may further confirm or modify this description.

*A New Hydromedusa*. — On Aug. 10, 1901, a medusa with distinctively sarsian characters was taken in the tow, similar in many respects to two species described by Forbes in 1848 (British Naked-Eyed Medusæ), chief among their features being the prolific development of medusæ from the body or manubrium of the parent medusa. Haeckel likewise described a similar medusa

from the Canary Islands, in which secondary medusæ were budded in great numbers from the very long siphonlike manubrium. So far as I am aware, no member of the genus *Sarsia* having similar characters has been described from American waters.

Forbes's species were *Sarsia gemmifera* and *S. prolifera*, as cited above, pp. 57–59. The former, like Haeckel's *S. siphonophora*, buds its secondary medusæ from the walls of the long manubrium in a spiral-like raceme throughout its entire length. In the specimen under consideration the proliferous medusæ are budded from the manubrium, but in a whorl about its base (cf. Fig. 3). Only a single specimen was taken, but its characters were so definite that there seems little doubt as to its specific distinctness.

The following characters summarize its more distinctive features: Bell high, somewhat ovate, or elongate hemispherical; tentacles four, with prominent basal bulbs, orange-colored, with marginal fringe of delicate green, each bulb with a prominent ocellus densely black and facing outward. Manubrium long, pendulous, extending far beyond the margin of bell, capable of great contraction; terminal portion doubly bulbous, with proximal bulb light sky-blue, terminal green; basal portion of manubrium expanding into an orange-colored gastric pouch which graduates into the body of the bell. Gonads medusoid, in a whorl about the base of the manubrium; ectoderm transparent or faintly tinged with pale blue, entoderm orange-colored. Height of bell, 1.5 mm.; breadth, 1 mm.

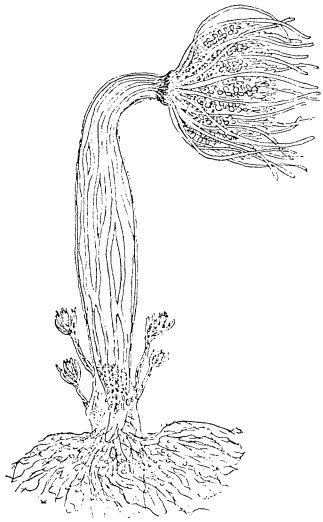


FIG. 2. — *Corymorpha pendula* Ag. with *Tubularia parasitica*.

For this medusa the name *Corync producta* is proposed. The description is based upon a single specimen, and while its characters seem sufficiently definite to warrant specific distinction, it is not impossible that other specimens in larger numbers may necessitate modification or change at certain points.

## SEASONAL ASPECTS.

The seasonal range among medusæ is noteworthy in many cases, both by reason of its periodicity in certain species and by its perennial character in others. The following are among the distinctively spring medusæ.

*Hybocodon prolifer* Ag. is one of the most restricted in this respect, ranging from late February to about the middle of May. It is one of the most beautiful and brilliant of the early medusæ. Its proliferous budding of secondary medusæ from the large single tentacle is an interesting and well-known feature. I have also found it producing actinulæ from the walls of the manubrium at the same time. These seem to arise much as do similar larvæ, from several other anthomedusa, and a histological examination shows essentially similar features of oögenesis and spermatogenesis, though there is no appreciable distinction of sexes so far as morphological features are concerned.

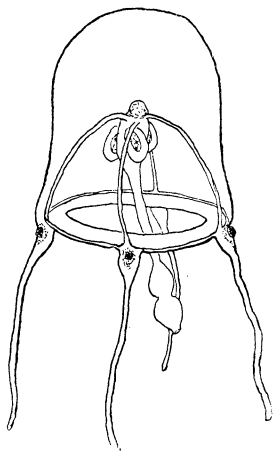


FIG. 3. — *Coryne producta*.

*Tiaropsis diademata* Ag. This is likewise an early medusa. According to Agassiz, "one of the earliest visitors of our wharves in spring." During the present season it has been taken from March 20 to May 1, though only in limited numbers.

*Coryne mirabilis* Ag. is also one of the earlier medusæ, but with a longer range, from February to May. It has been reported by Fewkes as occasionally taken at Newport in early summer.

*Lizzia grata* A. Ag. Of this medusa I have records during the present year from March 27 to April 29. Fewkes has reported it as occurring at Newport during the entire summer, but this would seem to be somewhat unusual.

*Tima formosa* Ag. This beautiful medusa, one of the largest of the early Hydromedusæ, while not specially rare at

this station, is not specially abundant. Its season is comparatively brief, ranging from April 12 to May 5. While sometimes quite abundant at certain localities, its hydroid phase is as yet unknown, as is also its development.

*Trachynema digitale* A. Ag. This Trachomedusa is occasionally taken here in considerable numbers in April, but is not a common medusa. Little appears to be known as to its habitat or life history, but it is probably more or less pelagic, and hence subject largely to the influence of ocean currents, etc.

*Rhegmatores tenuis* A. Ag. Note is made in this connection of the occurrence of this medusa in large numbers during the summer of 1900, the first record during several years, and its utter absence during the present season. It is usually recognized as a summer medusa, and the present record only confirms this. What is more specially worthy of note is the erratic aspect of its appearance, apparently at long intervals, and then usually in great numbers, indicating seemingly some local or environmental condition as governing its occurrence, rather than purely seasonal mutations. Were Rhegmatores a pelagic medusa we might account for mutations of this sort through the agency of shoreward currents or winds, as often happens with *Physalia*, and perhaps also with *Trachynema*, as intimated above. But so far as I am aware, this medusa, in common with most of the Hydromedusæ, is more or less restricted to the littoral fauna, and hence only incidentally affected by such influences. This is another medusa whose hydroid yet remains unknown. Possibly when its life cycle is fully known the apparent capriciousness of its occurrence may be cleared up.

*Staurophora laciniata* A. Ag. was likewise taken in considerable numbers in early May by Mr. George M. Gray, and later in the month by Dr. H. M. Smith. So far as my records are concerned, this is the first occurrence of this medusa in several years at this station. One of its peculiar structural features, the early confluence of the oral lobes with the frills of the gonads, so that they can only be distinguished with difficulty, was described by A. Agassiz. No mention, so far as I am aware, has been made of the origin of actinulæ in this

medusa by a method very similar to that of *Hybocodon*. In *Staurophora*, however, they arise within the greatly folded borders of the gonad pouches beneath the radial canals. As in the former, no conspicuous differentiation of sex was apparent in *Staurophora*, though not having seen them alive, and not having as yet examined the histology of the gonad region, this can only be stated tentatively.

Among medusæ taken during midsummer, the more common were *Nemopsis bachei* Ag., very abundant during August; *Bougainvillia carolinensis* Ag., likewise abundant during August; *Pennaria tiarella* McCr., less abundant than during previous seasons; *Ectopleura ochracea* A. Ag., unusually abundant during August, taken mostly in the evening tow; *Eucheilota duodecimalis* A. Ag., *Eucheilota ventricularis* McCr., not uncommon during August; *Eutima limpida* A. Ag., fairly common, but sexually immature; *Lafwa calcarata* A. Ag., not uncommon, and in many cases the several phases in the development of the medusa were taken. *Dipurena conica* A. Ag. and *D. strangulata* McCr. were taken, but from a comparison the specimens so intergraded as to suggest a probability of their specific identity, with only varietal differences.

Of rarer medusæ the following were taken: *Willia ornata* McCr., taken in considerable numbers at various times during the summer, were evidently breeding, as medusæ of all sizes and stages of development were found; *Podocoryne carnea* Sars, taken sparingly; *Epenthesis folcata* McCr., not numerous, colors less brilliant than those figured by Mayer for this species. Species of *Obelia* were notably few during the present summer, in rather sharp contrast with previous records. It is one of the few medusæ with a record extending throughout the entire year and often occurring in immense numbers, this latter being common with many species of *Obelia*.

#### SCYPHOMEDUSÆ.

These medusæ were more than usually abundant during the summer, a thing not common at Woods Hole except very early. Many specimens of *Aurelia*, *Cyanea*, and *Dactylometra*

were taken about the docks of the fish commission during July, and even August, which were sexually mature, and from some of which ova were obtained and the development followed as described below. That these were not an isolated few left over from the earlier numbers of April and May is evident in that many were taken in the open waters of Vineyard Sound, and even in the open sea far from land in the region of the Gulf Stream, mostly of the genus *Cyanea*. They may have been caught up by southward currents from a more northern locality along the coast of Maine or beyond, and carried to these southern ranges.

Specimens taken into the laboratory and placed in aquaria discharged developing ova in great numbers, literally covering and packing the bottom of the aquaria. The following synopsis of the development of *Cyanea* may not be without interest as having been carried on under the wholly artificial conditions of the aquarium, from the later cleavage of the egg on to the freeing of the ephyræ, — a circumstance not hitherto recorded, so far as I am aware, though Bumpus has recorded the fact that earlier phases occur readily under such conditions, and both McMurrich and Hyde likewise refer to the same fact, but they do not seem to have succeeded in tracing the entire development.

The early cleavage phases of *Cyanea* are passed while the ova are still within the gastric cavity or while “nursed” within the ample folds of the manubrium or frilled oral margins. A typical blastula results from total and regular cleavage and appears to be followed by an early gastrulation and the prompt obliteration of the blastopore.

Soon after this, and while the larvæ are still within the egg membrane, cilia are developed, and they may be seen slowly rotating within the membrane, which, however, is early ruptured and the embryo escapes as a free-swimming organism. In shape it is at first almost spherical, but soon takes on the oval or pyriform shape characteristic of most planulæ. Details as to the origin and differentiation of the endoderm are not yet worked out, but they seem to conform rather closely with the observations of Hyde and the later conclusions of Smith



on Aurelia, as well as with the recent work of Hein on the same form.

The larval history seems to vary greatly as to matters of growth, transformation, etc. A few specimens attached themselves to the bottom of the aquaria in from six to ten days and promptly assumed the typical scyphistoma stage, while others were swimming planulæ at the end of as many weeks, showing no tendency toward transformation.

*Encystment.* — Both McMurrich and Hyde have recorded an encysting phase in the life of the planula preceding metamorphism. Hyde noted, however, that in one series of experiments this did not take place. My own observations have probably sufficed to reconcile these discrepancies by showing that it is incidental rather than essential, — a mere adaptation to changed conditions.

That encystment may and does occur under certain circumstances is not in the least doubtful, if not indeed a more or less common phenomenon in development under artificial conditions. A very considerable proportion of my own specimens passed through such a stage, which varies from a few days to many, and is, indeed, often a permanent and fatal one; but, on the other hand, it is not less certain that many passed through the metamorphoses without the least sign of encystment, while in others there was the aspect of incipient encystment common in many hydroid planulæ, namely, the secretion of a delicate perisarc-like sheath over the base of the planula in the process of attachment. There seems little doubt, therefore, that in these variable aspects we have the clue to the entire matter, so far as these larvæ are concerned, and may consider encystment, as above intimated, to be an adaptation against unfavorable conditions, and therefore comparable with the same phenomenon among Protozoa and other organisms. May it not hint the probable phyletic origin of the perisarc structure so largely characteristic of one class of coelenterates, to which the facts under consideration may show more or less definite reversion?

*The Scyphistoma.* — The young scyphistoma is at first of vasiform shape, the base small and adherent by the delicate

film of horny secretion referred to above. The primary tentacles are usually four in number and arise as small buds from the broad oral end of the polyp about the same time as the mouth is formed. In many cases the number varies, only two arising at opposite sides, two others following at intermediate positions. More rarely only three tentacles occur in the primary set, followed by three others likewise in intermediate positions, giving the polyp at first a trimerous and later a hexamerous aspect,—a condition usually associated with the phenomenon of a triangular mouth which continued even during the entire history of the polyp. In several cases bifurcated tentacles occurred, and continued during the scyphistoma stage. The average number of tentacles is sixteen, though this may also vary considerably, many specimens being noted with twenty or more. The scyphistomæ of *Cyanea* are almost clear white in color, in rather marked contrast with the dull flesh color of the polyp of *Aurelia*, and when viewed in colonies against a black background present a most beautiful picture.

*Stolonization*.—This is a much less common feature in *Cyanea* than in *Aurelia*, though not by any means rare. Stoloniferous processes may arise from the bases or sides of the polyps, and growing laterally may become attached and serve as points of origin for new buds. They are, however, fewer in number and give rise to no such complex colonies as are frequent in polyps of *Aurelia*. No cases of the direct origin of secondary polyps from the body of the parent were noted in the case of *Cyanea*.

*Strobilization*.—Owing to the small size of the polyp of *Cyanea*, strobilization is comparatively inconspicuous and was only at first noted about the time the fully formed ephyra rendered the fact evident and directed attention to it. The segments are few in number, in many cases a single one only occurring at a time, though three or four are not unusual; but in no case were more than five noted upon any given specimen. In the cases of polystrobilous specimens the basal portion seemed to renew its activities, new tentacles arising and the specimen showing every indication of healthy development,

probably later strobilating as before, though no demonstration of this was undertaken.

The time involved between the attachment of the planula and the assumption of the strobila stage and the discharge of ephyrae was like that of the planula history, quite variable. The minimum time noted between the attachment of the planula and the assumption of the strobila stage was ten days, making the time from the origin of the planula to that of the strobila about seventeen days, or about eighteen to twenty days for the appearance of the ephyra. But as before intimated, there is much variation on this point, probably more than occurs in natural conditions.

*The Ephyra.*—Ephyrae liberated in the aquarium seemed quite normal in morphological aspects. In color they are dull brownish, the color showing itself as the strobilization proceeds toward maturity. In habit the young ephyra appears somewhat sluggish, and, while capable of active movement by the contractions of its bell, lies rather quiescent in the aquarium, seldom moving except as stimulated by agitation of the water or otherwise. While in rest it lies upon the aboral surface, with the manubrium extended upward, probably a condition assumed for the capture of prey.

Several specimens were marked by definite variation in the number of lobes or other organs. A specimen with nine lobes had also a similar number of rhopalia, while another with eight normal lobes had three extra rhopalia irregularly disposed at intermediate positions. Several specimens taken in the tow showed also similar variations, as did likewise several adult specimens taken during the summer and at previous times.

*Feeding.*—In rearing the polyps several experiments were made upon the feeding habits. Scrapings of slime, algæ, etc., from the eelgrass, which contained numerous Protozoa, were found to be among the most successful sorts of diet. Larvæ of gastropods and starfish were also taken readily by the polyps, the former especially being apparently quite acceptable. Diatoms and other micro-organisms taken from the deep waters of the Sound apparently proved deleterious, the polyps in aquaria supplied with this food showing evident and

rapid decline of vigor and health. In small aquaria numerous cases of cannibalism were noted, the scyphistomæ greedily devouring any planula which came within the grasp of the vigilant tentacles, the entire process of engulfing the victims being several times observed.

*A Cubomedusa from Woods Hole.* — Several specimens of an interesting medusa of this order were taken in the tow, the first on August 13, in Great Harbor, a second the following day at North Falmouth, Buzzards Bay. Two or three others were taken within the next day in Great Harbor.

In general features the medusa resembles very closely one figured by Mayer from the Tortugas (*Bull. Mus. Comp. Zool.*, Vol. XXXVII, No. 2, p. 70), and to a less degree a medusa described by Fewkes from the Bermudas (*Bull. Mus. Comp. Zool.*, Vol. XI, No. 3). In many respects, however, it differs from both, namely, in its larger size, deeper color, apparent absence of gastric filaments, figured by Mayer. Both Fewkes and Mayer consider the specimens taken by them as immature, and their identification was accordingly somewhat doubtful, the former assigning his to the genus *Tamoya*, the latter referring his, together with that of Fewkes, to the genus *Charibdea*. Certain it seems that unless the specimens are immature they could hardly be included within either genus, or indeed within any other of the at present recognized genera of the family. The absence of velar canals and pedalia, as well as the very short tentacles, would of themselves be sufficient to exclude them.

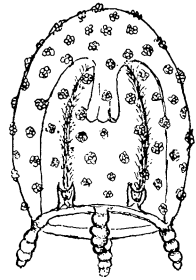


FIG. 4. — *Charibdea verrucosa*.

The same is likewise true of the specimens under consideration. They are so nearly identical in morphological features, size, etc., as to suggest something like maturity, unless, perchance, they should be indigenous species, — an exceedingly doubtful supposition. If borne hither from the Tortugas or Bermuda by currents, it would seem that the time involved in transit should have given at least some differentials of size or other peculiarity.

The following descriptive characters may serve to show in how far they fail to conform to the type characters of the genus: bell ovoid in profile, cuboid as seen from either pole; size from 2 to 3 mm. in short diameter by 4 to 5 mm. in height. Color a dull amber, somewhat translucent; exumbrellar surface dotted irregularly with light brownish warty clusters of nematocysts. Tentacles brown in color, rather short and spindle-shaped, with deep annulations. Rhopalia four, radially located, set in rather deep pockets somewhat above the level of the margin, each with several ocelli near the tip. Velarium well developed, and strengthened by four frenulæ or thickenings of the subumbrella in the region of the radii. Absence of any traces of velar canals is noteworthy, as is likewise absence of mesenterial filaments. Distinct gonads could not be distinguished, though sections showed a genital region and ova in process of development. Manubrium well developed, quadrate in form. In case the specimens may be referred to the genus *Charibdea*, it must be upon the assumption of immaturity, as Mayer has suggested, in which case they compare fairly well with Mayer's *C. aurifera*, though in size somewhat larger and more brownish in color. If, as seems not unlikely, they must be given specific distinctness, I would propose for the species the name *verrucosa*, as significant of the warty knots of nematocysts which adorn the outer bell.

THE ZOÖLOGICAL LABORATORY,  
SYRACUSE UNIVERSITY, May 1, 1902.